SEAL FOR MOVABLE VEHICLE ROOF

REFERENCE TO RELATED APPLICATIONS

[1] The present invention claims the benefit of German Patent Application No. 103 08 592.0, filed February 27, 2003.

TECHNICAL FIELD

[2] The invention relates to a seal for a guide of a cover panel of an openable vehicle roof, comprising an elastic sealing profile having a reverse side for mounting and a sealing side. The invention also relates to a vehicle roof having at least one cover panel that is slidable and tiltable to selectively cover a roof opening, lateral longitudinal guides for the cover panel, and at least one connecting member between a longitudinal guide and the cover panel.

BACKGROUND OF THE INVENTION

[3] There are currently vehicle roofs designed with movable cover panels. These roofs usually comprise a roof opening, at least one cover panel that is slidable and tiltable to selectively cover the roof opening, lateral longitudinal guides for the cover panel, and at least one connecting member between a longitudinal guide and the cover panel. Vehicle roofs of this type are also called spoiler roofs, in which the cover panel tilts over the roof surface and then can be slid towards the rear above the roof surface.

[4] To expose the greatest possible surface area of the roof opening, the cover panel is at least partially slid over a non-moveable, stationary roof segment. Longitudinal guides are arranged to the side of this roof segment. The cover panel moves into the area of these longitudinal guides, which nevertheless up to this point in time are closed to the outside by a seal that is disposed above the cover panel to protect the longitudinal guides, the interior, and the entire tilting and sliding mechanism from adverse environmental conditions, especially dirt and humidity.

[5] Great demands are placed on seals of this type. After the cover panel is tilted, it remains connected to the longitudinal guides via connecting members, usually cranks or coulisses made of metal. If the cover panel, along with the connecting members, is displaced and arrives in the area of the seal, the connecting members push the seal to the side. The

result is relatively high wear and tear and a large amount of flexing, which significantly increases the displacement forces required to move the cover panel.

[6] There is a desire for a seal structure that can withstand the demands of the cover panel movement without experiencing the excessive wear and tear of existing structures.

SUMMARY OF THE INVENTION

[7] The present invention is directed to a seal as well as a vehicle roof having a seal, in which the seal experiences a significantly smaller amount of flex as the cover panel is moved, significantly reducing the amount of friction and wear and tear on the seal.

[8] A seal according to one embodiment of the invention includes a separate sliding strip or latch that is attached to a sealing profile of the seal. This sliding strip, which is advantageously attached to the sealing side of the sealing profile, acts as a contact surface for the connecting members so that they do not have to slide directly against the resilient, soft material of the seal profile itself. The sliding strip does not influence the sealing behavior in any way because the sealing profile itself performs the sealing function outside the area of the sliding strip. As a result, the seal has functionally different segments made of different materials, namely the soft sealing profile for sealing and deformation, and the relatively hard sliding strip for easy sliding and the application of force.

[9] When the seal is in an unstressed state, the sliding strip is recessed from at least one sealing surface on the sealing side of the sealing profile. This is to assure that the sliding strip does not influence the sealing effect because the sealing surface of the sealing profile protrudes laterally to be able to contact a part situated opposite the seal and to seal the part off.

[10] According to one embodiment of the present invention, the vehicle roof of the type cited above has longitudinal guides that are each at least partially shielded from the outside by the seal. The associated connecting member, when the cover panel is moved, contacts the sliding strip and compresses the sealing profile without actually touching the sealing profile itself. The connecting member thus assures deformation of the sealing profile to expose a gap through which the connecting member can protrude to the outside.

[11] The seal according to the present invention can be used with any type of openable panel in addition to the spoiler roofs discussed above. More particularly, the inventive seal

structure can be used in any vehicle panel structure where good sealing properties and good sliding properties are both desired.

[12] In the tilted and displaced state of the cover panel, the vehicle panel according to one embodiment of the present invention is designed such that the connecting member extends from the associated longitudinal guide along the seal up to the cover panel that is situated over the panel surface. However, in this context, the connecting member makes contact with the seal only on the sealing strip.

[13] If the seal needs to seal a large gap, two seals can be placed next to each other such that their sealing surfaces are compressed against each other to assure the seal. The connecting member then presses the seals apart as it slides.

BRIEF DESCRIPTION OF THE DRAWINGS

[14] Further features and advantages of the present invention will become apparent from the discussion below and from the drawings below, to which reference is made.

[15] In the drawings:

[16] Figure 1 is a perspective view of one embodiment of an inventive vehicle roof with an exposed roof opening;

[17] Figure 2 is a perspective cutaway view of a seal according to one embodiment the present invention in the uninstalled state;

[18] Figure 3 is a schematic cross-sectional view taken along line III-III in Figure 1 in the area of a left longitudinal guide in the direction of travel;

[19] Figure 4 is a perspective cutaway view of the seal in Figure 2 with a connecting member in contact with the seal to compress the seal,

[20] Figure 5 is a schematic top cutaway view of an installed seal and a connecting member that protrudes through the seal, and

[21] Figure 6 is a schematic cross-sectional view of the seal according to another embodiment of the invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[22] The present invention is generally directed to a seal as well as a vehicle roof having a seal, in which the seal experiences a significantly smaller amount of flex as the cover panel is moved, significantly reducing the amount of friction and wear and tear on the seal.

[23] A seal according to one embodiment of the invention includes a separate sliding strip or latch that is attached to a sealing profile of the seal. This sliding strip, which is advantageously attached to the sealing side of the sealing profile, acts as a contact surface for the connecting members so that they do not have to slide directly against the soft material forming the seal profile itself. The sliding strip is advantageously made of hard plastic, but it could also be made of metal. The sliding strip markedly improves the sliding properties of the overall seal, especially when the sliding surface is configured to have a very small peak-to-valley height. The sliding strip does not influence the sealing behavior in any way because the sealing profile itself performs the sealing function outside the area of the sliding strip. As a result, the seal has functionally different segments made of different materials, namely the soft sealing profile for sealing and deformation, and the relatively hard sliding strip for easy sliding and application of force.

[24] The sliding strip is advantageously accommodated in the sealing profile in a form-locking manner and has its sliding surface partially protruding from the sealing profile. Alternatively or additionally, the sliding strip can also be glued to the sealing profile, joined to the sealing profile by vulcanizing or other similar processes, or co-extruded with the sealing profile during manufacture of the seal.

[25] When the seal is in an unstressed state, the sliding strip is recessed from at least one sealing surface on the sealing side of the sealing profile. This is to assure that the sliding strip does not influence the sealing effect because the sealing surface of the sealing profile protrudes laterally to be able to contact a part situated opposite the seal and to seal the part off.

[26] In one embodiment, the sealing profile has a closed hollow profile, which provides a high degree of elasticity at a relatively low level of flex.

[27] The sealing surface of the sealing profile is advantageously situated opposite a reverse side of the sealing profile so that compression stresses on the seal act perpendicular to the sealing surface and not parallel thereto.

[28] The sealing profile in accordance with one embodiment of the invention has a B-shaped cross-section with two bulbous sealing surfaces. The sliding strip is disposed between the bulbous sealing surfaces. A sealing profile having this shape has been proven to be especially advantageous because it assures a very good sealing effect and relatively easy deformability while still allowing good and reliable accommodation of the sliding strip.

[29] According to the present invention, the vehicle panel of the type cited above has longitudinal guides that are each at least partially shielded from the outside by the seal. The associated connecting member, when the cover panel is moved, contacts the sliding strip and compresses the sealing profile.

[30] The connecting member thus assures deformation of the sealing profile to expose a gap through which the connecting member can protrude to the outside.

[31] The connecting member according to one embodiment has an extension that contacts the sealing strip. The extension is particularly useful when the sealing strip is recessed from the sealing surface. The extension can be configured in a wedge-like fashion to make continuous compression of the sealing profile possible when the cover panel is displaced.

[32] As noted above, in one embodiment, the seal should cover at least the segment of the longitudinal guide that runs beside a non-moveable, stationary roof segment area. The seal provides a sealing function with respect to the stationary roof segment when the cover panel is not displaced.

[33] The seal according to the present invention can be used with any type of openable vehicle panel in addition to the spoiler roofs discussed above. More particularly, the inventive seal structure can be used in any vehicle roof structure where good sealing properties and good sliding properties are both desired.

[34] In the tilted and displaced state of the cover panel, the vehicle panel according to one embodiment of the present invention is designed such that the connecting member extends from the associated longitudinal guide along the seal up to the cover panel that is situated over the panel surface. However, in this context, the connecting member makes contact with the seal only on the sealing strip.

[35] The sealing strip should have good sliding properties, but it should also be sufficiently flexible such that it is deformed only in the area of the connecting member, when

the connecting member is moved along. This is to minimize the formation of a gap that would otherwise be large enough to allow humidity to penetrate into the longitudinal guide.

[36] If the seal needs to seal a large gap, two seals can be placed next to each other such that their sealing surfaces are compressed against each other to assure the seal. The connecting member then presses the seals apart as it slides.

[37] The invention will now be discussed in greater detail with respect to the figures. Figure 1 shows a vehicle roof panel 10, which is manufactured as a finished supplier part and which is secured to a roof frame 12. In the illustrated example, the vehicle roof 10 has stationary, non-moveable roof segments 14, 16, 18, that form the roof surface. In this context, one segment 16 is configured as a stationary glass panel, which assures a certain penetration of light for the front seat occupants.

[38] The roof is openable by means of two cover panels 20, 22 that can be slid toward and away from the rear of the vehicle to cover and uncover a roof opening 23. Each cover panel 20, 22 has its own set of associated longitudinal guides 30, 32, respectively, which are disposed on both sides of their respective cover panels. One of the cover panels 20 is arranged to be displaceable in a linear direction; when it is displaced, the cover panel 20 slides to the rear under one of the roof segments 16, as depicted in Figure 1. The other cover panel 22 is tiltable in the upward direction due to a jog 34 in the longitudinal guide 32 as well as displaceable toward the rear of the vehicle.

[39] The connection between the first cover panel 22 and first set of associated longitudinal guides 32, which is advantageously executed as a coulisse guide, is realized by one or more connecting members 40. The connecting members 40 can be made of any rigid material, such as metal, and my also be hinged if desired. Both sets of longitudinal guides 30, 32 run along the sides of the stationary roof segment 16. At least in an area on the sides of the stationary roof segment 16, the longitudinal guides 30, 32 are sealed from above by a seal 50, which protects the longitudinal guides 30, 32 from the penetration of humidity and dirt.

[40] Figure 2 shows this seal 50 in more detail. The seal 50 includes a sealing profile 52 made of elastic material, which runs in an elongated and hose-like manner and has a B-shaped, closed hollow profile in the illustrated embodiment. On a reverse side 54 of the sealing profile 52, a web adhesive band 56 is disposed for securing the entire seal 50 is secured on the side of the roof segment 16 or on a lateral roof frame 60. On the sealing side

opposite the reverse side 54, the seal 50 also has a sliding strip 62 made of a rigid material, such as plastic, having good sliding properties and running over the entire length of seal 50. The sliding resistance of the sliding strip 62 is less than the sliding resistance of the sealing profile 52, making the sliding strip 62 an appropriate surface for moving sliding components. In one embodiment, the hardness of the sliding strip 62 is significantly greater than the hardness of the sealing profile 52.

[41] In the illustrated embodiment, the sliding strip 62 has a T-shape cross-section. The crossbar of the "T" is accommodated in a form-locking manner in a complementary recess in the sealing profile 52, and the longitudinal bar of the "T" protrudes slightly from the sealing profile 52 and has a sliding surface 64 that faces the outside of the seal when the seal 50 is in a stressed, compressed state. When the seal 50 is in an unstressed state (Figure 2), the sliding surface 64 is recessed from the inside of the seal 50 from the two bulbous sealing surfaces 66 and 68 of the sealing profile 52. In the installed state (see Figure 3), the seal 50 is attached at the upper end of the lateral frame 60 and sealingly closes off the stationary roof segment 16. In the illustrated embodiment, the stationary roof segment 16 includes a glass pane 70 and a frame-shaped foam structure 72 surrounding it. The lateral surface 74 of the upper bulbous sealing surface 66 contacts the frame-shaped foam structure 72 in a sealing manner.

[42] When the cover panel 22 is displaced toward the rear of the vehicle, the seal 50 is compressed (e.g., toward the left in the direction of the arrow shown in Figure 3) so that the connecting members 40 can protrude from the longitudinal guide 32 in the upward direction up to the cover panel 22. For this purpose, the connecting members 40 in the area of the sliding surface 64 have an extension 80 with a wedge shape when viewed from above and that points toward the outside to the sliding surface 64. The extension 80 is disposed at a level so that it only contacts the sliding surface 64 and not the sealing profile 52

[43] If the cover panel 22 is tilted upward and is moved toward the rear of the vehicle, then the extension 80 presses against the sliding surface 64 to compress the sealing profile 52 (Figures 4 and 5). In this way, a gap 90 is created, and the connecting member 40 protrudes through the gap. The connecting member 40 does not contact the sealing profile 52 itself at all, ensuring no wear and tear on the sealing profile 52 as well as only a small amount of flex in the sealing profile 52.

[44] Advantageously, in the vehicle longitudinal direction, the seal 50 resumes its sealing function at both ends of the extension 80, as depicted in Figure 5, so that gap 90 is not too long to minimize any possibility of environmental contaminants entering the longitudinal guide 32. The seal 50 also can extend over the entire length of longitudinal guides 32, so that no two different seals border on each other.

[45] In the embodiment shown in Figure 6, two seals 50 are positioned as mirror images of each other and contact each other at their respective sealing surfaces 66, 68 in a biased manner to seal a larger gap. The connecting member 40 then presses to the outside both against sliding surfaces 64 and seals 50 in opposite directions. This embodiment is particularly useful for sealing larger gaps while still taking advantage of the properties of the inventive structure.

[46] It should be understood that various alternatives to the embodiments of the invention described herein may be employed in practicing the invention. It is intended that the following claims define the scope of the invention and that the method and apparatus within the scope of these claims and their equivalents be covered thereby.